

BOTTLE

FIELD OF THE INVENTION

The present invention relates to transparent or translucent bottles
5 comprising a blend of metallocene polyethylene and a homopolymer high
density polyethylene.

BACKGROUND OF THE INVENTION

One popular form of laundry detergent is the heavy duty laundry liquid.
Its popularity is due in part to the convenience of the product form, in particular
10 the ability to apply the detergent readily to soiled areas of the clothes. The
popularity of laundry liquids has created a need for more convenient
containers for dispensing these products.

Laundry liquid detergents have traditionally been sold in opaque bottles.
15 These bottles have been improved over time to incorporate measuring cups
serving as closures, and fitments incorporating drainage mechanisms and
pouring spouts. Bottles that are less opaque than those traditionally used
have been placed on the market recently. While these bottles are less opaque
than those traditionally used, they remain to be cloudy.

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The use of bottles having greater clarity can be aesthetically appealing
to consumers as the consumer can see the consistency of product, suspended
particles if they are present, separation of phases if a dual phase composition
is present or other aspects or properties of the laundry liquid product.

25 Transparent bottles may also be appealing to consumers during use as it
enables the consumer to ascertain easily how much product remains.

It is also desired to produce bottles for heavy duty laundry liquid detergents that have a high gloss on the outer surface. This helps makes the product stand out from other packaging when presented on the store shelf which helps sales of product.

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It is of increasing interest, therefore, to develop a transparent bottle that is suitable for holding liquid products such as heavy duty laundry liquid detergent. It is of further interest for such bottles to have a high gloss on the outer surface.

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ADDITIONAL INFORMATION

Efforts have been disclosed for making bottles or containers that are more clear or transparent. Many of these efforts have dealt with other 15 concerns when using a clear bottle such as the protection of the bottle and its contents from UV radiation which may be harmful to the bottle and its contents.

For instance, US 6,159,918 a clear bottle is disclosed comprising UV absorber to protect the contents. WO 97/26315 (to Colgate) discloses 20 transparent containers.

Other art such as Stehling et al. U.S. Pat. No. 5,382,631 is directed to interpolymer blends which may comprise linear polyethylenes prepared by catalyst systems of the metallocene type. It is said that the blends of the 25 invention can be used to advantage in all forming operations, such as blow molding, injection molding and roto molding and that molded articles include single and multilayered constructions in the form of bottles, tanks, etc.

Hodgson et al. U.S. Pat. No. 5,376,439 discloses a polymer composition 30 comprising a blend of a very low density ethylene polymer and a low to medium density ethylene polymer.

Metallocene catalysts may be used. The invention also provides for films prepared from the blend which may have a single layer construction or a laminated ABA construction wherein the A layer comprises the blend of the invention and the B or core layer comprises a different olefin layer such as

5 high density polyethylene.

Metha et al. U.S. Pat. No. 5,358,792 is directed to heat sealable compositions comprising a) a low melting polymer comprising an ethylene based copolymer having a density of from 0.88 g/cm³ to about 0.915 g/cm³

10 and b) a propylene based polymer. The ethylene based copolymer is produced with a metallocene catalyst.

A Hodgson U.S. Pat. No. 5,206,075 is directed to a laminar polyolefin film material having a base film layer which is a blend of an olefin polymer and

15 a very low density copolymer of ethylene. The VLDPEs which may be used as the copolymer component of the base or sealing layers of the film of the invention can be polymerized with the use of metallocene catalyst systems.

The films are said to be very useful for high speed packaging operations.

20 Wu U.S. Pat. No. 5,422,172 discloses an elastic laminated sheet made of a nonwoven fibrous web and an elastomeric film. The elastomeric film may be made using metallocene catalysts.

Cheruvu et al. U.S. Pat. No. 5,420,220 discloses a film of a linear low

25 density copolymer of ethylene (LLDPE) said to have excellent processability, optical properties and impact strength. The resins are said to exhibit narrower molecular weight distribution.

The following patents relate to metallocenes: Wood et al. U.S. Pat. Nos.

30 5,419,795, Georgelos et al. 5,397,640, Georgelos 5,397,613, Quantrille et al.

5,393,599, Agur et al. 5,128,091, Petropoulos et al. 5,021,109, Kioka et al.
4,874,734, Sypula et al. 4,747,992 and Rim et al. 4,668,834.

Other containers are illustrated in Rogler et al. U.S. Pat. Nos. Des.
5 353,541, Ring Des. 351,347, Ring Des. 348,612, Darr et al. Des. 332,747,
Jacobs Des. 300,005, Visser Des. 272,318, Platte Des. 265,797, Kaplan Des.
192,886, Price Des 195,697, Lyons Des. 286,379, Gonda Des. 305,407,
Chambers Des. 306,410, Davis Des. 311,864, Carmine Des. 312,964, Fiore et
al. Des. 321,624, Beechuk et al. Des. 326,052, Baird et al. 4,846,359, Krall et
10 al. 5,232,107, Mallin 3,385,461 and WO 94/25350.

SUMMARY OF THE INVENTION

15 In a first aspect, the present invention is directed to a monolayer bottle,
comprising a blend of metallocene polyethylene polymer and a homopolymer
high density polyethylene.

20 In a second aspect, the present invention is directed to a bottle
fabricated from two or more layers, comprising an outer layer, wherein the
outer layer is a blend of metallocene polyethylene polymer and a homopolymer
high density polyethylene.

25 In a third aspect, the present invention is directed to a bottle fabricated
from either a single layer or two or more layers, comprising an outer layer,
wherein the outer layer is a blend of metallocene polyethylene polymer and a
homopolymer high density polyethylene, and wherein the bottle has at least
10% transmittance of light in the visible spectrum.

30 In yet other aspects, the present invention is directed to a bottle
comprising a downwardly extending body that is either monolayer or fabricated

- from at least two layers, including an external and internal layer wherein the monolayer or external layer is a blend of metallocene polyethylene polymer and a homopolymer high density polyethylene and wherein the bottle further comprises a finish having an annular mouth, the body extending axially
- 5 downwardly along a vertical axis from said finish to a base; the body including a shoulder extending outwardly and downwardly below the finish.

For purposes of this invention, in regard to bottles comprised of at least two layers, the term "inner" layer or "internal" layer means the most inner layer
10 of a multilayer bottle wall. The term "outer" layer or "external" layer means the most outer layer of a multilayer bottle wall. The term "middle" layer means any layer that is between the inner or outer layer of the bottle wall.

For purposes of this invention, bottles that are said to be "monolayer"
15 have a bottle wall that is comprised of a single layer which of course is also an external or outer layer.

The present invention is directed to bottles for dispensing liquid household products such as liquid detergents and liquid fabric softeners. The
20 bottle may have either a monolayer or multilayer construction wherein the monolayer or outer layer is comprised of a blend of metallocene polyethylene polymer and a homopolymer high density polyethylene.

In further embodiments, the bottle body is combined with other features
25 such as a downwardly extending body having axially extending side panels fabricated from either a monolayer or multiple layers. The container is preferably in the form of a bottle having a drainback fitment. Advantageously, the bottle is more clear and has a higher gloss than a traditional liquid laundry bottle, but at the same time is functional as a heavy duty liquid detergent or
30 other dispenser. With use of the metallocene polyethylene polymer/homopolymer high density polyethylene blend in accordance with the

invention, the bottle may be significantly more transparent and have higher gloss without adversely affecting other properties.

The bottles of the invention have greater clarity and higher gloss than a
5 traditional bottle made of polyethylene yet continue to have properties, such as
stress crack resistance, suitable for use with liquids such as laundry liquids.

The metallocene polyethylene polymer used in the bottle of the
invention has a density of from about 0.91 g/cm³ to about 0.95, g/cm³ and
10 preferably, from about 0.92 g/cm³ to about 0.95 g/cm³, and most preferably,
from about 0.93 g/cm³ to about 0.94 g/cm³ and includes all ranges subsumed
therein.

Metallocene polymers are described in Stehling et al. U.S. Pat. Nos.
15 5,382,631 and Mehta et al. 5,358,792, the disclosures of which are
incorporated by reference herein. Preferred metallocene polyethylene polymer
include Finacene BM359 SG available from Atofina and mPact D449 available
from Phillips Chemical Company.

20 The homopolymer high density polyethylene used in the bottle of the
invention has a density of greater than about 0.957 g/cm³ and preferably,
greater than about 0.96 g/cm³. Preferred homopolymer high density
polyethylenes have a 60° gloss greater than 20 as measured by the ASTM D
2457-03 method. A preferred homopolymer high density polyethylene is
25 Finathene BM 961 available from Atofina.

The bottle is also suitable for other uses, including liquid fabric
softeners, light duty liquid detergents, e.g. hand dishwashing detergents),
automatic dishwashing detergents such as gels, chemicals, and foods.

Pouring of product from the container is believed to be facilitated by an off-centered neck. The bottles of the various embodiments of the invention may also include an optional handle or other integral gripping feature.

5 In the multilayer embodiment of the invention, the bottle is advantageously fabricated with certain resins. In addition to the outer layer comprising a metallocene polyethylene polymer/ homopolymer high density polyethylene blend, it is preferably that the middle layer employs at least 25% recycled resin.

10 All percentages in this specification and claims, unless indicated otherwise, are intended to be percentages by weight.

15 All numerical ranges in this specification and claims are intended to be modified by the term about.

20 As used herein, the term "comprising" means that a specified material or element is present, optionally together a further material or element, and includes including, made up of, composed of, consisting and/or consisting essentially of.

25 As used herein, "handle" refers to a structure for holding the bottle where there is a "hole" through which the human hand can extend. A gripping feature is a pair of indentations facilitating the holding of the bottle by a human hand, but which does not include a "hole."

30 For a more complete understanding of the above and other features and advantages of the invention, reference should be made to the following detailed description of preferred embodiments and to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

- FIG. 1 is a perspective view of a container of the invention with the closure fastened.
- 5 FIG. 2 is a section along the lines 2--2 of FIG. 1.

DETAILED DESCRIPTION OF THE INVENTION

Referring now particularly to the drawings, a bottle of the invention will
10 be described with respect to a specific embodiment. In FIGS. 1 and 2 there is
shown a container 2 including a bottle 6 having an integral handle 8 and a
neck 10. The container 2 also includes a drainback fitment 14. Fastened to the
top of the container 2, as viewed in FIG. 1, there is a closure or cap 12. All of
the foregoing components are preferably molded from a resilient flexible plastic
15 material. The materials may be selected so that the plastic from which the
drainback fitment 14 is molded is softer than the materials from which the
bottle 6 and closure 12 are formed. Alternatively, the drainback fitment may be
made of a material of comparable hardness to that of which the closure is
made, e.g., polypropylene or HDPE.

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The drainback fitment has an outer, frustoconical wall portion 16 which
gradually tapers downwardly and inwardly and is received within the neck 10
of the bottle 6. The wall portion 16 terminates at its upper end in an annular rim
19. Rim 19 is generally flat.

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The surface of the rim turns downwardly and inwardly to form the outer
wall 24 of a circumferential well 26 surrounding a generally frustoconical,
eccentrically positioned (off-center) spout 36, the lower periphery of which
forms the inner wall 28 of the circumferential well 26. Between the outer wall
30 and inner wall 28 of the circumferential well 26 there is a sloping floor 30.

The outer surface of wall 16 optionally includes a retaining ring which is spaced from and generally concentric with rim 19. Wall 16 may include a product exit aperture (or drain port) located above and spaced from the product drainage aperture 32. The basic features of the fitment, bottle finish 5 and closure are as shown in FIG. 9 of Davidson et al. U.S. Pat. No. 5,108,009, the disclosure of which patent is hereby incorporated by reference herein. An appropriate product drainage aperture is illustrated in more detail in FIG. 3 of Davidson et al.

10 The spout may include projections to keep the fitments separated during stacking. Such projections may also serve to prevent rotation of the spouts during stacking when combined with lugs (not shown) depending from the bottom of the fitment and situated so that they block radial movement of the stacking projections on the next lower fitment when the fitments are 15 stacked.

Notch 32 and longitudinal slot 34 provide a path for residual liquid remaining on the spout 36 or closure 12 to drain back into the bottle 6 either directly or via the downwardly sloping floor 30 of the circumferential well 26 20 under the force of gravity when the container 2 is in an upright position.

Preferably, the container of the invention provides the spout and drainback area in the form of the above described fitment, separate from the body of the bottle. In the described preferred embodiment, the fitment snaps 25 into the container finish so that a friction fit is obtained between the outer wall of the fitment and a locking ridge on the inside of the container finish. A fitment may also be provided in other ways, e.g. it may be applied by spin welding, or by hot melt adhesive or by the EMABOND system. An internally threaded finish may be combined with an externally threaded closure.

The EMABOND system employs a thermoplastic gasket impregnated with metal particles. When the gasket is in position (between a sealing area ridge of the fitment and inside bottle neck ledge), a sealing unit with an electro-magnetic force presses down on the fitment and heats up the metal particles, 5 thereby melting the plastic gasket, and the compression welds the two components together with a leak-proof seal.

Fitment 14 may be secured to bottle finish 68 by a friction fit. Bottle finish 68 includes an annular mouth 70, and a locking ridge 72. The finish 10 includes threads 74. The fitment is inserted into the bottle by forcing it through the opening at the bottle mouth and pushing it until annular rim 19 of the fitment is situated upon or above locking ridge 72. If rim 19 is above locking ridge 72, preferably it is immediately above. In this position, the distal end of the annular rim will be adjacent to bottle mouth 70. Optionally, a retaining ring 15 of the fitment helps to retain the fitment in position by abutting the lower aspects of locking ridge 72.

If desired, the spout 36 may be provided with an anti-drip lip. Also, it may be desirable to provide the spout with a V-shaped pouring angle for 20 improved control of pouring of the product.

The drainback fitment 14 may be formed from a thermoplastic such as high density polyethylene. Or it may be made of a polyethylene which is a product of a 50:50 blend of a high density resin and a low density resin. The 25 high density resin can be U.S.I. LS 506 or a similar resin. The low density resin can be U.S.I. LS 208 or the like. Instead of a mix of resins, a low density polyethylene such U.S.I. 241 or even a harder material such as polypropylene may be used to form the fitment. Other plastic resins having chemical and physical properties similar to the aforementioned resins can be used in 30 fabricating the drainback fitment 14.

Although the fitment would normally be a separate piece, it may also be formed integral to the bottle. A threaded collar could then be spin welded onto the exterior of the bottle to mate with the threads of the closure.

5 It is also contemplated that some of the embodiments may be in the form of refill bottles which contain a plain screw cap and no spout but which are capable of receiving a transferable spout and self draining closure.

10 The closure 12 has a closed end 38 at its top which is merged at its circumference with a downwardly extending inner circumferential wall 46 having a surface onto which there are integrally molded gripping teeth 42 biased to present greater friction to the hand when the closure 12 is rotated counterclockwise to loosen it than when it is rotated clockwise for tightening. Alternatively, other gripping means, such as vertical ribbings may be
15 employed.

20 Complimentary fastener means in the form of threads are provided on the closure 12 and neck 10 of the bottle 6 at their juncture. The closure 12 has internal threads 50 which mate with external threads 74 on the finish 68 of the bottle.

As the closure 12 is threaded onto the neck 10 of the bottle 6, the liner, if present, engages the mouth 70 of the bottle 6 thereby sealing the bottle to prevent leakage of the contents from the container. When the liner is omitted,
25 the top of the channel seals against the mouth 70 of the bottle. The presence of the fitment rim below the top of the finish permits the closure (or the liner of the closure) to form a seal at one point at the top of the finish. If the fitment rim extended over the top of the fitment there would be two areas for liquid product to escape through the seal, above and below the rim of the fitment.

As is apparent from FIG. 2, except for the spout, fitment 14 is wholly contained within the bottle 6. The entire outer wall 16 is situated below the mouth 70 of this bottle.

5 Although the fitment herein has been described as having a single product exit aperture, a plurality of apertures may be utilized.

10 The closure may be formed of a harder material than that used in the drainback fitment 14. In the preferred embodiment of the invention, the plastic material from which the closure 12 is molded is a homopolymer polypropylene such as that sold by Phillips Petroleum Company under the designation Phillips HLV 120-01 or may be polypropylene copolymer.

15 The bottle 6 also may be formed of a material that is harder than the material employed in the drainback fitment 14. Alternately, the fitment may be formed of a harder material, as where the fitment is fabricated from polypropylene.

20 In accordance with certain embodiments of the invention, the bottle 6 is made from either a single layer (i.e. monolayer embodiment) or multiple polymeric layers, which include either a single layer in the monolayer embodiment or an outer layer in the multiple layer embodiment comprising a metallocene polyethylene polymer/ homopolymer high density polyethylene blend.

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The layer(s) of the bottle may be pigmented or non-pigmented.

30 In a preferred embodiment, the bottle comprises panels having a multilayer structure including i) an outer layer comprising a metallocene polyethylene polymer/ homopolymer high density polyethylene blend, ii) a middle layer comprising a minimum of 25% recycled resin, in-process regindr

plus some virgin resin, and iii) an inner layer comprising virgin natural high density polyethylene. It is especially preferred that the features of the individual or combined embodiments of the invention be present in a bottle fabricated from a multilayer structure including i) an inner layer including virgin natural
5 high density polyethylene and metallocene polyethylene, ii) a middle layer comprising a minimum of 25% recycled resin, and iii) an outer layer including a metallocene polyethylene polymer/ homopolymer high density polyethylene blend. Recycled resin is preferably HDPE homopolymer from used milk or water bottles and possibly used detergent bottles of about the same color.

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Ranges of thicknesses preferred in a multilayer embodiment would be 5-30% outer, 40-80% middle and 5-30% inner, with the percentages being a percentage of the total wall thickness of the bottle. More preferred ranges of thicknesses in a multilayer embodiment would be 10-20% outer, 70-80%
15 middle and 10-20% inner, with the percentages being a percentage of the total wall thickness of the bottle. A useful arrangement (percentage thickness) of layers is expected to be 10% outer layer, 80% middle layer and 10% inner layer.

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It is further preferred that the middle layer of a multilayer bottle be a high density polyethylene. This will assist in making the container more resistant to top load pressure. Examples of materials which may be used include Paxon AU55-003, a medium molecular weight distribution high density polyethylene copolymer available from Paxon Polymer Company of Baton Rouge, La., and
25 Paxon AC45-004, a high density polyethylene copolymer available from Paxon Polymer Company. Either of the above may advantageously be used in conjunction with a percentage, say 25% of a recycled resin, i.e., a post-consumer recycled resin (PCR) such as a high density polyethylene bottle scrap.

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In a multilayer embodiment, a preferred resins for the middle layer is Chevron virgin 9402 PCR polyethylene homopolymer (employs recycled PE). A preferred resin useful in blends for the inner layer is Chevron 9301 polyethylene.

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While trilayer structures will generally be preferred, quadlayer or other multilayer structures may also be used. While it will generally be preferred that inner and/or outer layer(s) be virgin (i.e. not recycled resin), the inner and/or outer layer(s) may include some recycled resin. Where the inner and/or outer 10 layer(s) includes recycled resin, one candidate will be blends containing LLDPE from recycled pallet stretch film. Other good candidates include LLDPE and LLDPE/HDPE blends, metallocene polyethylene (MPE) (e.g., Exxon's Exact) and MPE/HDPE blends. It will generally be preferred that the middle layer include at least 25% PCR. A foamed HDPE middle layer may also be 15 used.

The use of a neck or finish which is displaced from the center is believed to facilitate pouring of product from the container. To determine whether a neck finish is off-center for the purposes of the invention, one measures the 20 distance from one side to the other of the bottle's length, measured at the point of maximum length, i.e., the maximum horizontal dimension when the container is standing on its base. Then one determines the center point of that distance from one side to the other. The next step is to ascertain where the center point of the container finish, ie the center of the bottle mouth, falls along 25 the line drawn from one side of the container to the other at its longest length. The percentage displacement is calculated by subtracting the distance in position between the center point of the finish and the center of the container length at its widest point and dividing that figure by the length of the bottle at its widest point.

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An example of the percentage displacement calculation is as follows. If the container has its maximum length at the bottom, and the length of the bottom is 16 cm, and a vertical line drawn through the center of the finish intersects the length line at 10.6 cm, the calculation is as follows: (10.6 minus 5 8 (the midpoint of the length)), divided by 16. The result is 16.25%. For the purposes of the invention, a neck finish is considered off center if the displacement percentage is greater than 3%. Preferred displacements are from 3% through 20%. Especially preferred is if the percentage is from 5%-20%.

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Bottles made in accordance with the present invention have at least 10% transmittance of light through a 1mm thick sample at a wavelength 410-800 nanometers (i.e. visible light spectrum) wherein the composition is substantially free of dyes. For purposes of the invention, as long as one 15 wavelength in the visible light range has greater than 10% transmittance, it is considered to be transparent. Preferably, bottles in accordance with the present invention will have at least 15%, and more preferably 20%, and most preferably 25% transmittance of light through a 1mm thick sample at a wavelength of 410-800 nanometers. For purposes of the invention, as long as 20 one wavelength in the visible light spectrum has transmittance greater than a designated amount x, it is considered to have a transmittance of at least that amount x in the visible light spectrum. This transmittance can be easily measured by placing a sample having a thickness of 1mm in the light beam path of a UV-VIS Spectrophotometer such as the Hewlett-Packard 8451A 25 Diode Array Spectrophotometer.

The bottles of the present invention have superior gloss. Preferably the bottle exterior surface has a 60° gloss greater than 20 as measured by the ASTM D 2457-03 method.

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The examples that follow are provided to facilitate an understanding of the present invention. The examples are not intended to limit the scope of the claims.

5 Example 1

Example 1 is a bottles having a monolayer structure that is made of a metallocene polyethylene polymer/ homopolymer high density polyethylene blend. The metallocene polyethylene polymer and homopolymer high density polyethylene are both present in the blend at 50% by weight of the blend. The metallocene polyethylene polymer is Atofina Finacene BM359 SG. The homopolymer high density polyethylene used is Atofina Finathene BM961.

Example 2

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Example 2 is a bottle having a trilayer structure wherein the outer layer is made of a metallocene polyethylene polymer/ homopolymer high density polyethylene blend. The metallocene polyethylene polymer/ homopolymer high density polyethylene blend is the same 50/50 blend as used in Example

20 1. The various layers of the bottle are as illustrated in Table 1.

Table 1

Example 2	
Outer layer	50% metallocene polyethylene ¹
	50% homopolymer high density polyethylene ²
Middle layer	25% PCR ³
	50% regrind ⁴
	25% virgin HDPE ⁵
Inner layer	Virgin HDPE ⁵

¹ Metallocene polyethylene is Finacene BM359 SG by Atofina.

² Homopolymer high density polyethylene is Finathene BM961 by Atofina.

³ Grade 1 PCR homopolymer by KR Plastics.

⁴ Regrind is a blend of the other ingredients of the respective sample.

⁵ Paxon AM55-003.

In example 2 the outer and inner layers have a thickness of 10% of the
10 total wall thickness. The middle layer has a thickness of 80% of the total wall
thickness.

It was surprisingly found that bottles comprising a metallocene
polyethylene polymer/ homopolymer high density polyethylene blend had very
15 high gloss and very good clarity (transparency).

Advantageously, the bottle of the invention can be made on a wheel
machine, i.e., a high speed production blow molding apparatus, or a Uniloy
brand or other shuttle machine. A "wheel" machine rotates and clamps around
20 a continuously extruded comparison. Bottles are ejected after forming.

It will be apparent that the pouring fitment and container of the invention
may be used for liquid laundry and other detergents, fabric softeners and many
other types of liquid household and other products.

It should be understood, of course, that the specific forms of the invention herein illustrated and described are intended to be representative only, as certain changes may be made therein without departing from the clear
5 teachings of the disclosure. Accordingly, reference should be made to the following appended claims in determining the full scope of the invention.